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E-SYSTEMS
Montek Division

(#3) (2)

Report No. 131500-607
Date: 22 June 1977

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**VIBRATION TEST REPORT
FOR THE
AN/TRN-41 TACAN NAVIGATIONAL SET**

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~~PPG.~~

Prepared for:
Department of the Air Force
Headquarters Electronics Systems Division (AFSC)
Hanscom Air Force Base
Massachusetts 01731

DDC
NOV 3 1977
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Prepared by:
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✓
Contract No. F19628-75-C-0200
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This test report contains the results of the vibration tests performed on the AN/TRN-41 TACAN Navigational Set.		

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VIBRATION TEST REPORT

This test report contains the results of the vibration tests performed on the AN/TRN-41 TACAN Navigational Set.

1. **Test Identification.** Vibration test as defined in Appendix V-C of the Equipment Test Plan for Navigational Set, TACAN, AN/TRN-41.
2. **Functional Purpose of Test.** AN/TRN-41 system qualification.
3. **Test Objectives.** To demonstrate that the system meets the requirements of Specification No. 404L-701-5017A, Part 1, Paragraph 3.2.5.2.3 (20 August 1976).
4. **Description of Test Article.** The AN/TRN-41 system in the manportable configuration is made up of three packages consisting of the following:

Receiver-Transmitter, Radio, RT-1202/T

Antenna, AS -3132/T

Ancillary Group

Each of these three units and the Direct Current Power Filter, F-1439/T, were subjected to the vibration test as described in the equipment test plan.

5. **Summary of Test Results.**

- a. **Pre and Post Vibration Operational Tests.** All pre and post vibration operational tests were run successfully.
- b. **Vibration Tests.** There were no resonances observed during the search made on any of the units tested. Therefore, sinusoidal cycling was performed per the procedure.
- c. **Visual Inspection.** The visual inspection showed that there was no damage incurred to the units as a result of the vibration test.

6. **Description of Test Setup.** Each of the units under test was separately strapped to the vibration fixture and vibrated on three mutually perpendicular axes. The vibration fixture was a Ling Vibration Exciter Model 290 and a Ling Sine Wave Controller Model SCO-100. Pictures showing the vibration test set up are found in attachment 1 of this report.

7. **Photographs.** See Attachment 1.
8. **Test Equipment.** See Attachment 2.
9. **Test Data.** See Attachment 3.
10. **Test Conditions.** The tests were conducted in a test laboratory environment.

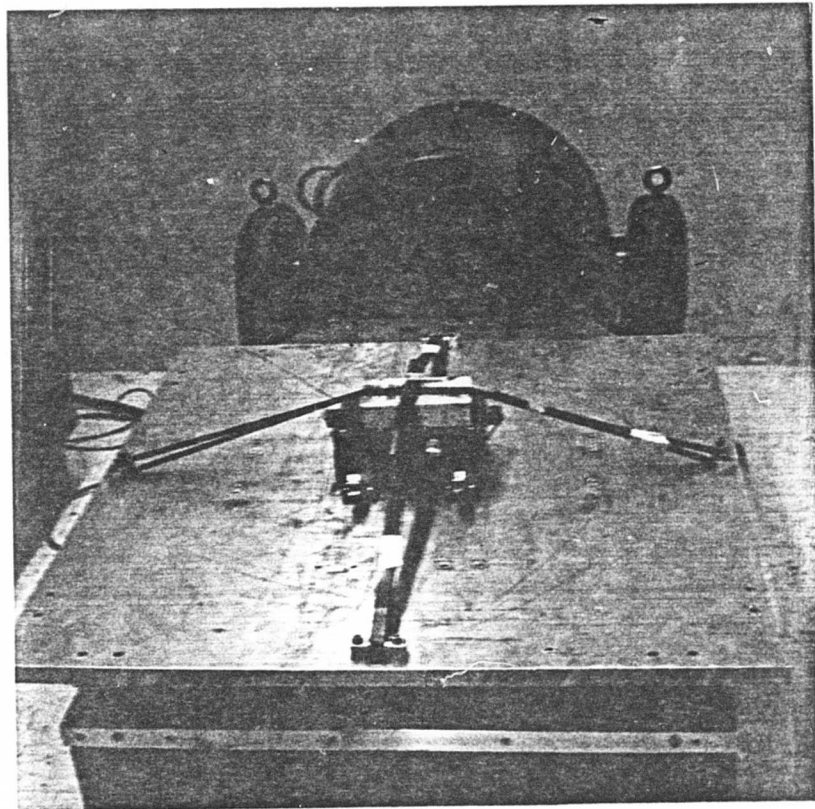
11. **Test Results Analysis.** The AN/TRN-41 system passed successfully the vibration tests as described in the equipment test plan. The vibration tests revealed no design weaknesses within the system.

Because the antenna and filter box were vibrated when a complete system was not available for system operational testing, individual operational tests for these units were run before and after vibration. The procedures for these individual unit tests are included in Attachment 4.

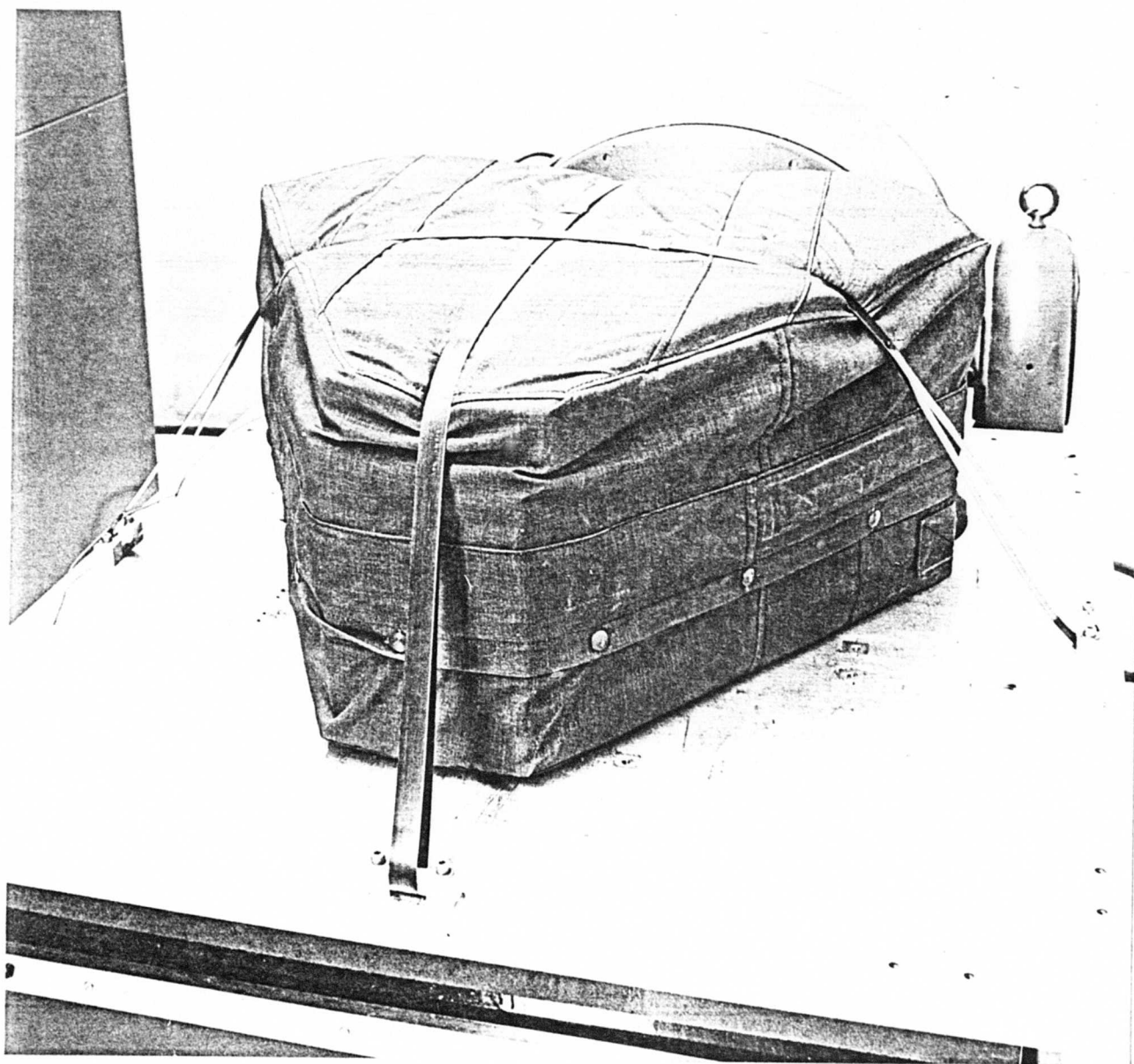
12. **Certification.** The data sheets shown in Attachment 2 have been signed by a Montek Quality Assurance representative and a DCAS representative, certifying that the test results are authentic, accurate, current and in accordance with the related test plan.

ACQUISITION for	
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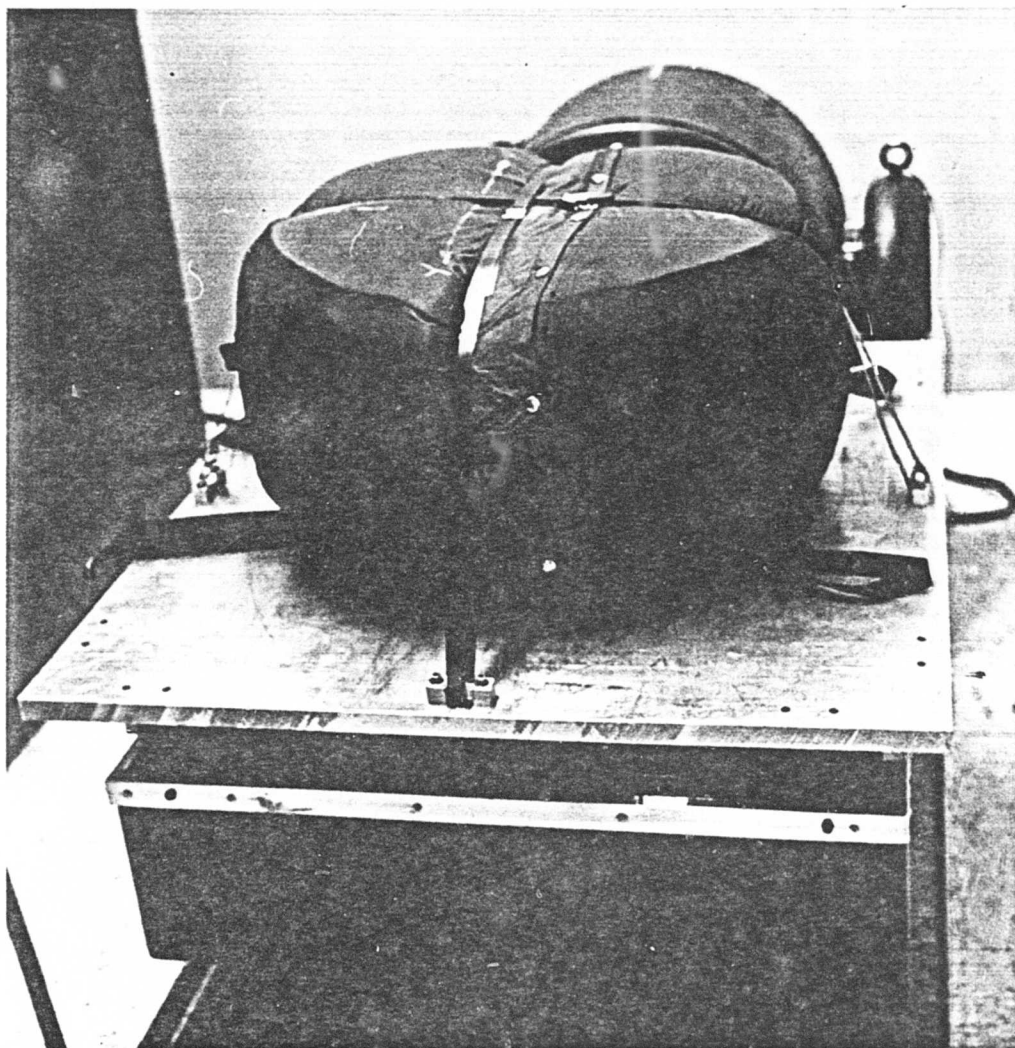
ATTACHMENT 1
PICTURES



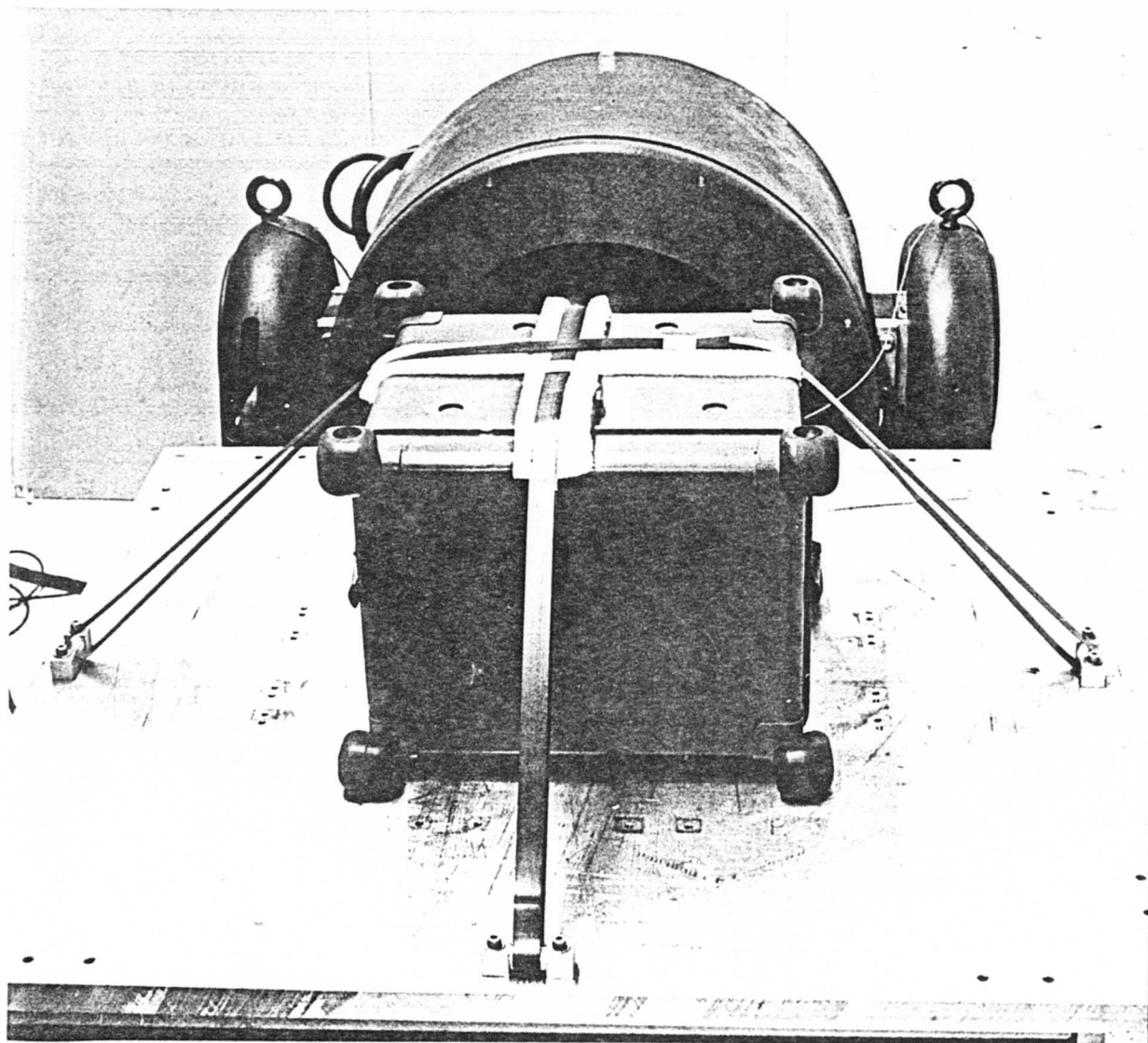
DC POWER FILTER VIBRATION TEST



ANTENNA SUPPORT ASSEYBLY - MANPORTABLE CONFIGURATION VIBRATION TEST



ANTENNA - MANPORTABLE CONFIGURATION VIBRATION TEST



RECEIVER-TRANSMITTER - VIBRATION TEST

ATTACHMENT 2
TEST EQUIPMENT

TEST EQUIPMENT

<u>Description/Manufacturer</u>	<u>Model</u>	<u>Calibration</u>
Oscilloscope, Tektronix S/N B251950	465	7/6/77
Signal Generator, RF, H.P. S/N B250	612A	6/23/77
Peak Power Meter, Boonton S/N B-463	89008	9/19/77
Pulse Generator, Data Pulse	1108	5/12/77
Counter, Fluke	1953	8/12/77
Half-Ampl. Det. Montek S/N 002	EM-144	6/2/77
RF Detector, Montek S/N 173	GRM97	5/24/77
Monitor Ant., Montek	006300	N/A
Test Box - Interconnection - Montek		N/A
Power Supply HP	62748	1/16/78
Power Supply Acopian		12/9/77
Power Supply, Sorensen	QR4075A	9/19/77
Directional Coupler 20 dB, Narda	3042B	2/13/78
Directional Coupler 10 dB, Microlab	CBA-78	
Variable Attenuator, Weinschel 0-10 dB	905	12/13/77
RF Attenuator, Weinschel	10 dB	N/A
Antenna Test Box, Montek	EM-148	11/22/77
Multimeter, Fluke	8120A	8/2/77
Vibration Exciter, Ling	290	N/A
Sine Wave Controller, Ling	SCO-100	N/A

ATTACHMENT 3
VIBRATION TEST DATA SHEETS

DATA SHEET VIBRATION

June 30, 1976

SYSTEM _____

DATE 4/8/77

UNIT	S/N	CUTOFF FREQ.	RESONANCE SEARCH AND DWELL FREQUENCIES AND AMPLITUDE																SINUSOIDAL CYCLING			VISUAL INSP. ✓ X
			X PLANE				Y PLANE				Z PLANE				X	Y	Z					
			1	2	3	4	1	2	3	4	1	2	3	4								
RECEIVER- TRANSMITTER 4/7/77	002	500 HZ	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
		Amp																			✓	
ANTENNA IN MANPORTABLE CONFIGURATION	003	500 HZ	✓																			✓
		Amp																				✓
ANTENNA SUPPORT ASSY IN MANPORT- ABLE CONFIG. 7/6/77	002	500 HZ	✓																			✓
		Amp																				✓
DC POWER FILTER 4/28/77	002	500 HZ	✓																			✓
		Amp																				✓

NOTES

1. RECORD THE FOUR MOST SEVERE RESONANCES FOR EACH PLANE. RECORD AMPLITUDE OF DWELL TEST FOR EACH FREQUENCY. (See Step C)
2. CHECK ✓ OR MARK X FOR EACH DWELL TEST AND SINUSOIDAL CYCLING.
3. CHECK ✓ INDICATES UNIT IS OK AND X INDICATES FAILURE.

* THERE WERE NO RESONANCES OBSERVED DURING THE SEARCH MODE ON ANY UNITS. THEREFORE SINUSOIDAL CYCLING WAS PERFORMED PER PROCEDURE
TECHNICIAN and [signature] DATE 4/28/77

ENGINEER [signature]

QA REPRESENTATIVE m. B. [signature]

DCASD [signature]

DATE 4/29/77

DATE 4-29-77

TEST DESCRIPTION VIBRATIONDATE 4/28/77OPERATIONAL TEST DATA SHEETS
FILTER, DIRECT CURRENT POWER, F-1439/T

	<u>Pre Test</u>	<u>Post Test</u>	
1. Input Resistance	<u>35.7</u>	<u>35.7</u>	35.7 \pm 4 Ω
2. Reverse Voltage Protect	<u>✓</u>	<u>✓</u>	Check if OK
3. Turn On Time	<u>100 msec</u>	<u>100 msec</u>	10 Msec
4. Voltage Drop from J1-1 to J2-1	<u>1.1V</u>	<u>1.1V</u>	1.5 volts

Test Engineer

Dave DaultDate 4/28/77

QA Representative

M.B. HuntDate 4/28/77

DCASD

Arthur Lee
J. JohnsonDate 4-28-77

DATA SHEET
ANTENNA OPERATIONAL TESTS

TEST Pre- V.I.B.
ANT SERIAL NO.: 003

DATE 4-6-77
TECH Dave Dault

I. Antenna Speed and Reference Triggers

	Specification	MEASUREMENTS		
		15 Hz	135 Hz	1350 Hz
PERIOD		66.666 ± 0.133 ms	7407 μ s ± 14.8 μ s	740 μ s ± 10 μ s
BASE LINE LEVEL	$\geq +3.5$ V	✓	✓	✓
PULSE AMPLITUDE	≥ 3.0 V	✓	✓	✓
PULSE RISE TIME	≤ 20 μ s	✓	✓	✓

II. Antenna Speed Error

Antenna speed error alarm condition (3.5 Vdc min.)

✓

Antenna speed error normal condition (0.7 Vdc max.)

✓

III. Voltage Standing Wave Ratio (VSWR)

$\leq 1.5:1$

1.3:1

IV. 15 Hz & 135 Hz Modulation (Check if OK)

✓

m. B. Junt 4/6/77

G. Horn Lon

D. Johnson

4-6-77

DATA SHEET
ANTENNA OPERATIONAL TESTS

TEST Post VIB And Pres Drop
ANT SERIAL NO.: 003

DATE 4/8/77
TECH _____

I. Antenna Speed and Reference Triggers

	Specification	MEASUREMENTS		
		15 Hz	135 Hz	1350 Hz
PERIOD		66.666 ± 0.133 ms	7407 μ s ± 14.8 μ s	740 μ s ± 10 μ s
BASE LINE LEVEL	$\geq +3.5$ V	5.0V	5.0V	5.0V
PULSE AMPLITUDE	≥ 3.0 V	5.0V	5.0V	5.0V
PULSE RISE TIME	≤ 20 μ s	< 1 μ s	< 1 μ s	< 1 μ s

II. Antenna Speed Error

66.667ms 7410.45 741 μ s

Antenna speed error alarm condition (3.5 Vdc min.)

✓

Antenna speed error normal condition (0.7 Vdc max.)

✓

III. Voltage Standing Wave Ratio (VSWR)

$\leq 1.5:1$ 1.39:1

IV. 15 Hz & 135 Hz Modulation (Check if OK)

✓

m. B. Hunt 4/8/77
C. H. L. 4-8-77
J. Johnson

DATA SHEET
OPERATIONAL TESTS
AN/TRM-41

Test *Vibration Test*

Date *4-14-77*

System *RT Ser No. 003*

Time *9:00 am*

Tech

Dave Spauld

VERIFIED mBZ 4/15/77 PRE TEST OK.

Para. No.	Description	Pre Test	Post Test	Post Test	Requirements	Units
6.1	Calibrated RF insertion loss $P_L = 31.2$ dB Used in determining RF peak power.	N/A	N/A	N/A	N/A	N/A
6.2	System turn on normal operation	✓	✓		Check if OK	N/A
6.3.1	Antenna radiated signal 15 Hz	✓	✓		Check if OK	N/A
	135 Hz	✓	✓		Check if OK	N/A
6.3.2	Antenna Speed	66.667	66.667		66.667 ± .133	ms
6.4.1.1	Correct identity code	✓	✓		Check if OK	N/A
6.4.1.2	Identity period	37.0	37.5		37.5 ± 3.75	Seconds
6.4.2	Peak power (1) Reading of peak power meter $P_m =$ (2) Convert to dBm - $10 \log$ $P_m \times 10^3 = P_m \text{ dBm}$ Total power output in dBm $P_{m \text{ dBm}} + P_L =$ *Insertion loss see 6.1 above.	90mw 19.54 50.74	90mw 19.54 50.74		N/A N/A 50 dBm	Watts dBm dB
6.4.3.3	Pulse count	7210	7210		7200 ± 180	Counts
6.4.4.2	Pulse shape Width (50%) Rise time (10-90%) Fall time (90-10%)	3.3 2.0 2.4	3.3 2.0 2.4		3.5 ± 0.5 2 ± 0.25 2.5 ± 0.5	µs µs µs
6.4.4.4	Pulse spacing	12.08	12.0		12.0 ± 0.1	µs
6.4.5.2	Delay - 60 ± 10 µs 15 Hz trig to first burst pulse.	✓	✓		Check if OK	

June 30, 1976

DATA SHEET
OPERATIONAL TESTS
AN/ILN-41 (Continued)

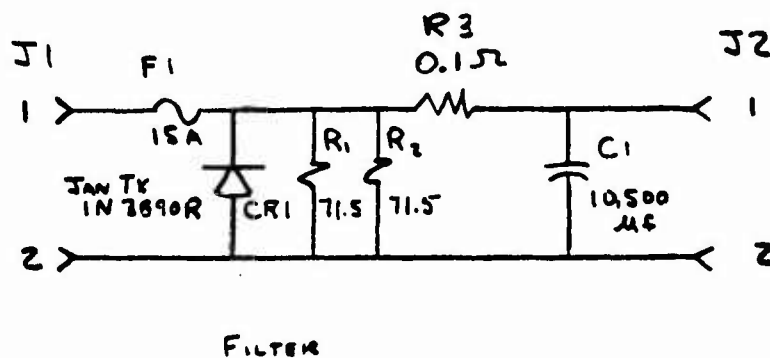
Para. No.	Description	Pre Test	Post Test	Post Test	Requirements	Units
6.4.5.3	Correct north Burst - 12 pulse pairs spaced $30 \pm 0.1 \mu s$	✓	✓		Check if OK	
6.4.5.5	Delay $60 \pm 10 \mu s$ - 135 Hz trig to first burst pulse	✓	✓		Check if OK	
6.4.5.6	Correct Aux burst - 6 pulse pairs spaced $24 \pm 0.1 \mu s$	✓	✓		Check if OK	
6.4.6.5	RT replies to 3300 interrogations	✓	✓		≥ 2310 (Counts/Second)	
6.4.6.7	Demand only mode - times to switch from ON to STBY within 70 ⁸⁰ seconds	65 ✓	61 ✓		Check if OK	
6.4.6.8	STBY mode	✓	✓		Check if OK	
6.4.6.9	Demand Only mode - time to switch from STBY to ON ≤ 15 sec	✓	✓		Check if OK	
6.4.6.10	ON AIR mode	✓	✓		Check if OK	
6.4.7.1	DME ONLY mode	✓	✓		Check if OK	
6.4.7.2	Switch from DME to TACAN	✓	✓		Check if OK	
6.4.8.1	Antenna Alarm - Within four seconds	✓	✓		Check if OK	
6.4.8.2	Alarm Reset	✓	✓		Check if OK	
6.4.8.3	RT Alarm - Within five seconds	✓	✓		Check if OK	
6.4.8.4	Alarm Reset	✓	✓		Check if OK	

ATTACHMENT 4
PRE AND POST OPERATIONAL TEST PROCEDURES
FOR ANTENNA AS-3132/T AND
FILTER, DIRECT CURRENT POWER, F-1439/T

FILTER, DIRECT CURRENT POWER, F-1439/T

Operational Tests - For Pre and Post Mechanical Tests

1. Resistance Test. Using the digital voltmeter measure the resistance from J1-1 to J1-2. Record on data sheet. It should be $35.7 \pm 4\Omega$.
2. Current limit the 28 volt power supply to .5 amps and connect the +28 VDC to J1-2 and the return to J1-1 and observe that because of current limiting the power supply voltage is reduced to less than 1 volt. Check data sheet.
3. Turn the power supply off and connect the +28 VDC lead to J1-1 and the return to J1-2. Observe with an oscilloscope J2-1 when the power supply is turned ON. The voltage should rise to 28 VDC and obtain this voltage in not less than 10 M seconds.
4. Connect a 2.8Ω resistor as a load across J2 pins 1 and 2. Apply 28 VDC to the input of the filter box J1-1 and the return to J1-2. Measure the voltage from J1-1 to J2-1. Record on data sheet. It should be less than 1.5 volts.



ANTENNA OPERATIONAL TESTS FOR PRE AND POST MECHANICAL TESTS

I. Antenna Speed and Reference Triggers.

To perform this subtest, proceed as follows:

- a. Connect the equipment as shown in Figure 1 with the test box ANT POWER switch in the OFF position.
- b. Adjust the power supplies for input voltages of $+24 \pm 0.5$ Vdc and $+5.0 \pm 0.1$ Vdc and place the ANT POWER Switch in the ON position.
- c. With the counter, measure the period of the 15 Hz, 135 Hz and 1350 Hz TRIGGERS at the test box and observe these triggers with the oscilloscope. Record the following characteristics on the data sheets.

(1) Period between triggers

15 Hz trigger	$66.666 \pm .133$ ms
135 Hz trigger	7407 ± 14.8 μ s
1350 Hz trigger	740 ± 10 μ s

(2) Trigger base line level $\geq +3.5$ Vdc

(3) Pulse Amplitude ≥ 3.0 Vdc negative from base line

(4) Pulse rise time - (10 - 90%) ≤ 20 μ s

II. Antenna Speed Error. To perform this test, proceed as follows:

- a. Connect the equipment as shown in Figure 1.
- b. Energize the equipment and monitor the antenna speed error on the test interface box. After the antenna gets up to speed, the signal should be low (0.7 Vdc Max.)
- c. Cause an antenna speed error by momentarily switching off the antenna on signal at the antenna interface test box and observe that the antenna speed error signal goes high (3.5 Vdc min.). Check data sheet.

III. Voltage Standing Wave Ratio (VSWR). To perform this subtest, proceed as follows:

- a. Remove pedestal from base of antenna assembly and connect the equipment as as shown in Figure 2.
- b. Place the signal generator in the square wave modulated mode and adjust the frequency to 1151 MHz. With gain and vernier controls set at approximately 1/2 minimum on the SWR meter, adjust the probe penetration of the slotted line to obtain an on-scale reading on the SWR meter. Move the probe along the slotted line until a maximum indication is obtained. By interacting adjustments of gain, vernier, and frequency controls on the SWR meter and by interacting adjustments of probe penetration and probe location on the slotted line, obtain a SWR meter reading of 1.0.
- c. Move the probe along the slotted line until a minimum voltage is displayed on the SWR meter. Record meter SWR reading on data sheet. The VSWR should be less than 1.5 to 1.

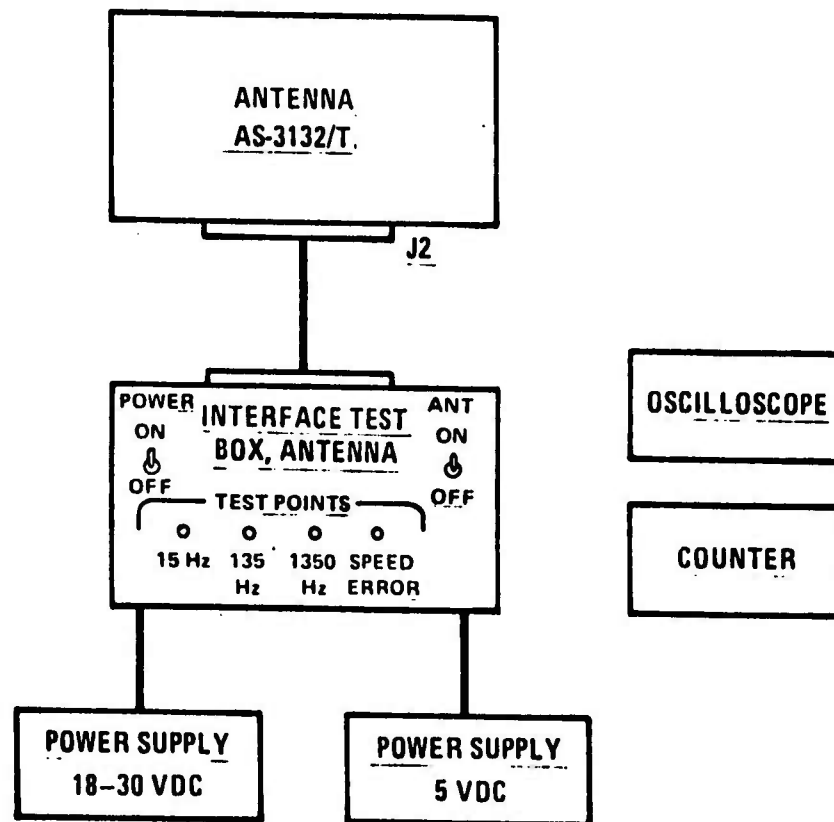


FIGURE 1

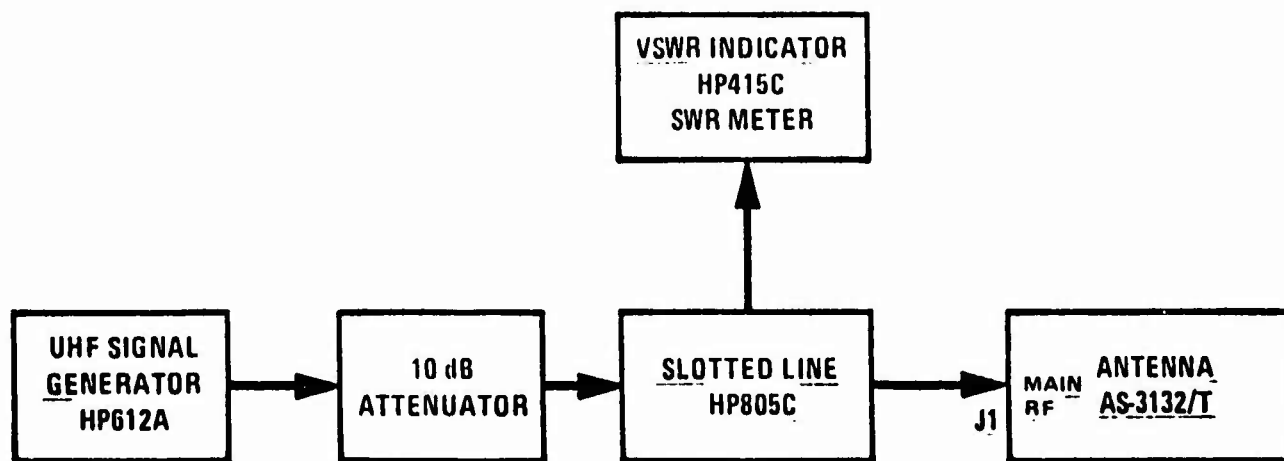


FIGURE 2

IV. 15 Hz and 135 Hz Modulation.

Use the antenna range and observe the modulation pattern when CW is radiated through the antenna ($f = 1213$ MHz). Check the data sheet if the 15 and 135 Hz modulation pattern is correct.

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